ARPA-E's 37 Projects Selected From Funding Opportunity Announcement #1

Project Title:	Carbon Nanotube Membrane Elements for Energy Efficient and Low Cost Reverse Osmosis
Organization:	NanOasis Technologies, Inc.
Funding Amount:	$2,030,940
Website:	www.NanOasis.com

Brief Description of Project

NanOasis proposes to utilize carbon nanotubes (CNTs) to make industrially-scalable reverse osmosis (RO) membranes having a performance improvement that could transform desalination and wastewater reuse, and produce dramatic energy savings. We target a ten-fold permeability increase compared to today's commercial state-of-the-art, resulting in a 30-50% energy savings, up to 90% reduced membrane utilization, 10-23% lower capital cost for new plants because of smaller footprint, and hence a reduction in the total cost of water by as much as 40%.

NanOasis has produced CNT seawater RO membranes with performance hitherto unseen in the desalination industry, all with an industrially-scalable fabrication process. In this ARPA-E R&D project, NanOasis will further refine this fabrication process to achieve the ten-fold permeability target. We expect per unit area costs to be lower than today's membranes, despite the use of CNTs. Packaged in the industry standard form-factor, NanOasis membranes will be drop-in replacements in existing plants. With their low cost and high energy savings, customer payback could be as short as a few months, resulting in rapid adoption.

Why ARPA-E Funding and Not Private Capital

Private capital to support early-stage, high risk technology opportunities is difficult to secure, particularly in today's financial environment, despite the significant long-term economic and social benefits that such technologies may promise. ARPA-E funding provides the critical bridge between breakthrough research with great potential and product commercialization.

Uniqueness/Benefits of Technology

NanOasis membrane technology could reduce reverse osmosis energy consumption by 30-50% in existing desalination plants by the drop-in replacement of legacy RO membrane elements with NanOasis ultra low pressure elements. On the other hand, in new desalination plants optimized around NanOasis' membrane technology, the total cost of water could be reduced by up to 40% by the combination of energy savings, membrane savings and smaller, less complex, lower cost facilities that could yield the same water output. Second only to agriculture, power generation is the highest consumer of water in the U.S. In addition to water for drinking and industry, America needs more water to power its economy. Over 10 years, 290TWh could be saved, corresponding to 177 million tons of CO2. This technology development would directly and indirectly create several thousand new jobs, helping the U.S. regain technology leadership in the area of water treatment.

Addressable Market & Potential Customers

Reverse osmosis is used to provide potable water by desalinating three main sources of input water: brackish inland waters, municipal wastewater and seawater. Globally desalination provides 13B gallons per day of potable water, yet this represents less than 1% of the world's demand for water. The global market for reverse osmosis membrane elements is forecast at $1.4B by 2015. However, given the improved economics offered by the NanOasis technology, the reverse osmosis market is expected to further expand.
NanOasis' technology is extensible to many other separations. By replacing thermal distillation with a NanOasis membrane process, industries ranging from petroleum to pharmaceuticals could be made more energy efficient, while having a reduced environmental footprint. The potential energy savings across these industries could exceed that in water applications, as could the value of membrane elements deployed in these industrial applications.

For inquiries, contact:

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Key Team Member Bios

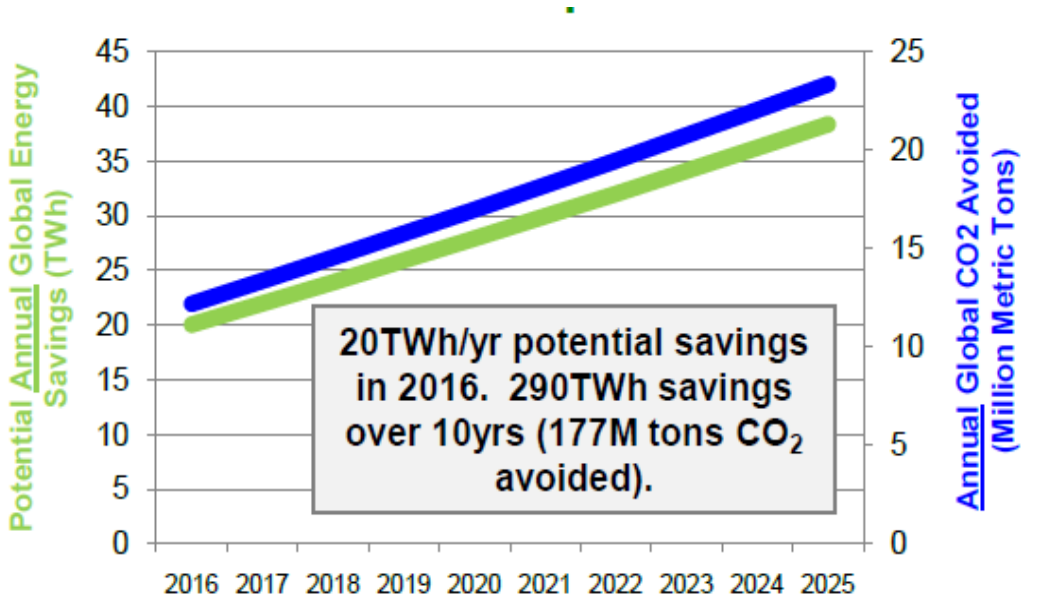
Dr. Jason K. Holt left Lawrence Livermore National Lab, where he was a Staff Scientist and principal investigator on several R&D projects, to co-found NanOasis as its Chief Technology Officer and commercialize the development of carbon nanotube membranes. Dr. Holt was a first author of the seminal 2006 paper "Fast Mass Transport through Sub–2-Nanometer Carbon Nanotubes", published in the journal Science. Dr. Holt is an expert in nanofluidics, nanocomposite synthesis and the development of platforms for the study of flow at nanometer length scales. Dr. Holt earned his PhD in Chemical Engineering from the California Institute of Technology.

Dr. Timothy V. Ratto served as staff scientist and principal/co-investigator for a large number of R&D projects at Lawrence Livermore National Laboratory before leaving to co-found NanOasis as Chief Scientific Officer. Dr. Ratto is an experienced experimental scientist and is a recognized expert in polymer thin film processing, self-assembly, and the structure and function of biological and artificial membranes. Dr. Ratto earned his PhD in Biophysics from the University of California at Davis.

Miscellaneous

NanOasis' investors include X/Seed Capital Management – a Silicon Valley based venture capital fund providing de-novo start-up capital for entrepreneurs pursuing breakthrough innovations.

Schematics/Photos of Technology or Personnel



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